TEXTURED NICKEL AND ALLOYS FOR RABiTS™ PROCESSED COATED CONDUCTORS

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Outline

- Current status
- Process characteristics
- Intrinsic issues
- Scale-up considerations
- Summary

Current Status: Metal Texture

- Same texture obtained in annealed short samples and in samples cut from 10 to 100 m annealed lengths.
- XRD results for short samples:

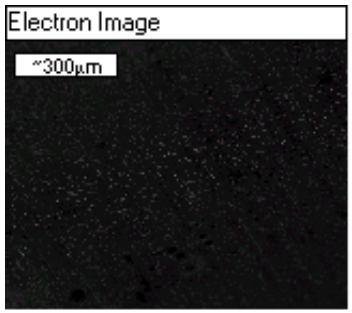
Temp. (°C)	% Cube	FWHM Omega	FWHM Phi
1100	98.3	7.32°	6.79°
1000	97.8	7.68°	6.75°
900	98.4	8.16°	7.33°

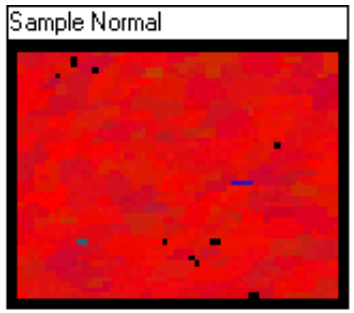
- XRD results for cut samples from continuously annealed:

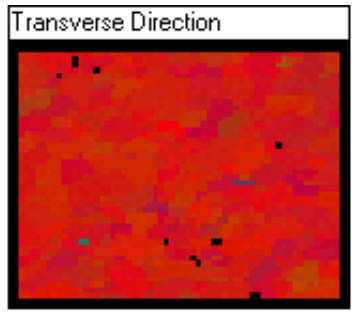
Temp. (°C)	% Cube	FWHM Omega	FWHM Phi
1150	97.9	6.46°	7.25°
1050	96.3	7.95°	7.95°
950	92.2	8.36°	8.36°
850	82.1	8.24	8.24

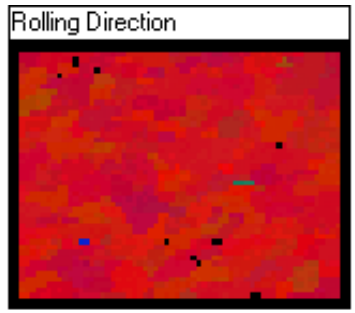
XRD data courtesy ORNL

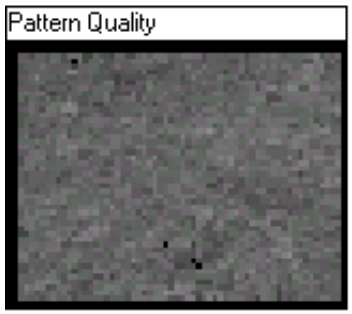
Current Status: Texture in 30 m length, front

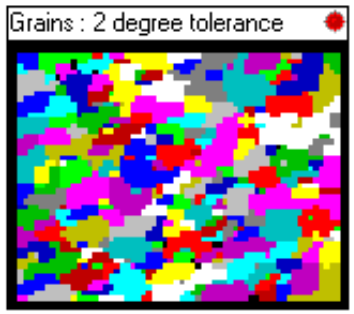


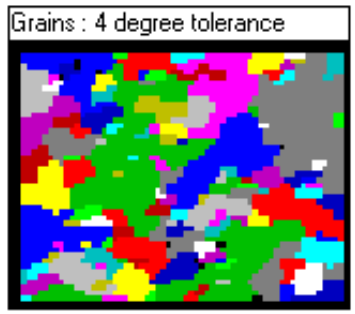


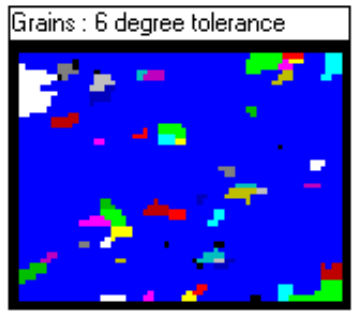


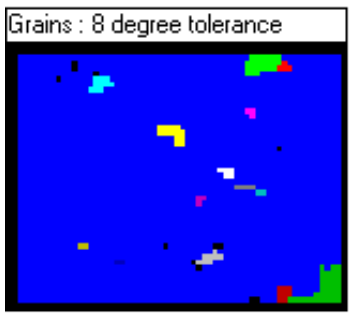


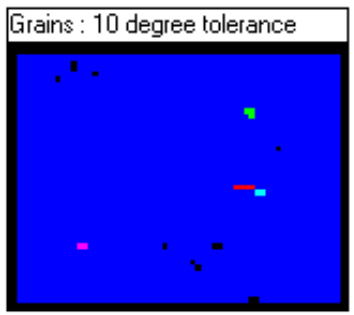






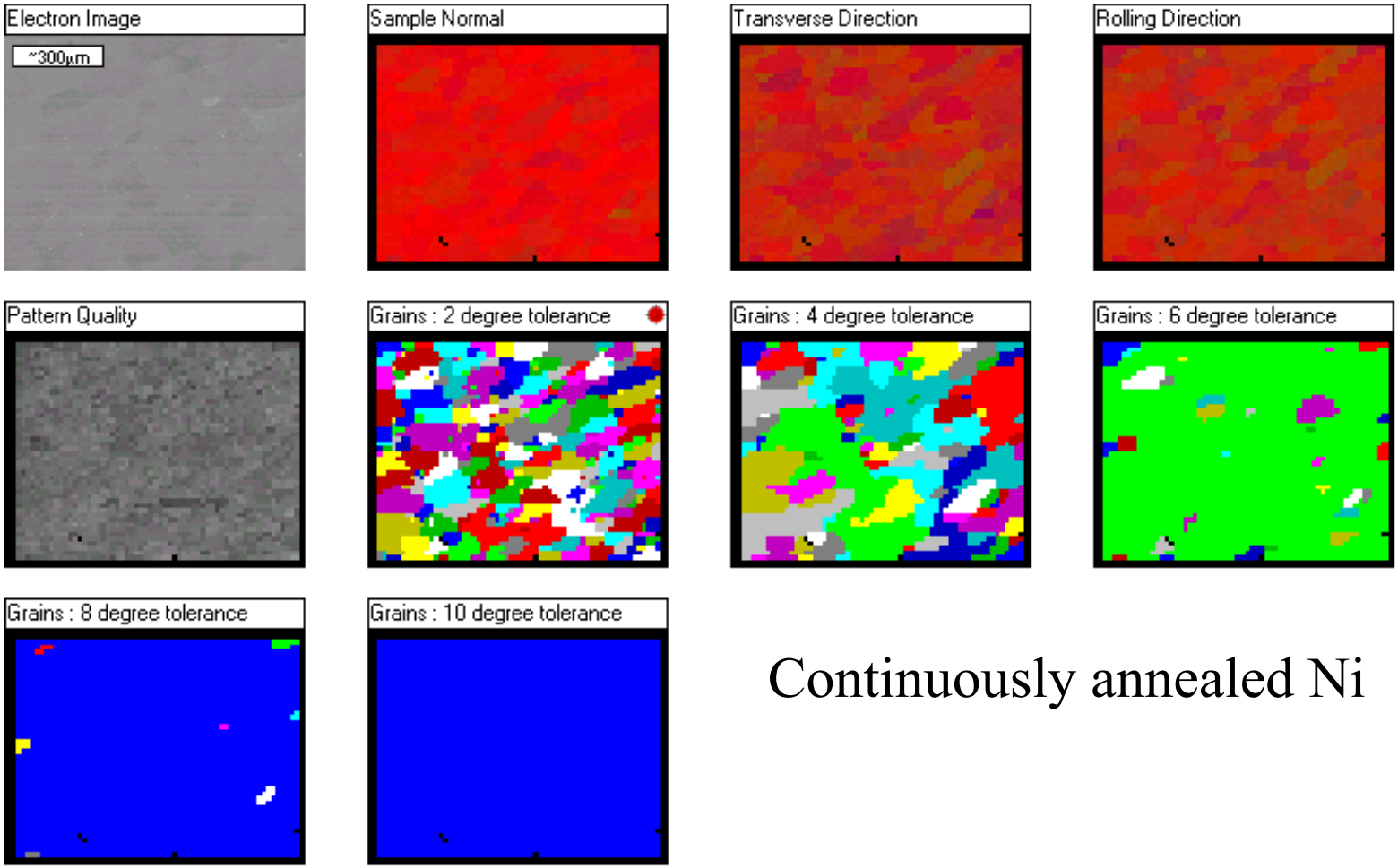






Continuously annealed Ni

Current Status: Texture in 30 m length, back



Continuously annealed Ni

Process Characteristics: Speed

- Rate limiting step is anneal, continuous anneal is presently 15 cm/min, this has not been optimized.
- Labor time for deformation is still largely controlled by setup times; starting from a rod, a batch can be processed in 2 to 3 days whether 10 m or 100 m batch. (Longest lengths at present ~150 m).
- Cleaning time is not optimized, presently ~1 m/minute.

Process Characteristics: Limits on Texture

- For the metal strip, the biggest influence found has been the starting material.
- For a given starting material, the deformation and annealing variables influence texture weakly (unless gross errors are made).
- A better understanding is needed of effect of starting chemistry and grain size/morphology on final texture of the metal strip.

Intrinsic Issues

- Surface smoothness is a key requirement; for CCVD, sputtered and evaporated buffers, R_A in 10 – 20 nm range has enabled 1 MA/cm^2.
- Surface defect elimination requires vigilance in process monitoring and control.
- Surface sulfur plays a critical role in achieving epitaxy, and control of sulfur is required for many coating methods.
- Secondary recrystallization remains poorly understood but remains an issue, particularly in vacuum cast material.

Scale-up Considerations

- All steps of the metal processing have been demonstrated for 100 meter lengths.
- There are no show stoppers for kilometer lengths.
- The main issue is reducing costs.
- Yields presently are quite low, mainly due to variability in starting material; specifications are inadequate.
- We need a better understanding of the effect of starting grain size, morphology, and impurity chemistry on the attainable texture.

Summary

- The biggest influence on final texture was found to be the starting material.
- For a given starting material, the deformation and annealing variables influence texture weakly (unless gross errors are made).
- A better understanding is needed of effect of starting chemistry and grain size/morphology on final texture of the metal strip.
- Cube textured metal processing has been demonstrated for 100 meter lengths.
- This process has enabled 1 MA/cm^2 for several coating methods.
- This process appears scalable to kilometer lengths.